

MAINTENANCE GUIDEBOOK VII TERMITE, INSECT AND RODENT CONTROL

CHAPTER SIXTEEN - RATS

SECTION A INTRODUCTION

Human beings, dogs, snakes, and birds, all of which have spinal columns, are vertebrates, while insects, worms, jellyfish, and snails are not. A few vertebrates, such as rats and mice, are common pests in urban sites. Others may occasionally become pests when their presence conflicts with human use of a space.

Public concern for animal welfare and the potential risk from vertebrate poisons to people, pets, and other nontargets have made rules governing vertebrate pest control particularly strict. Laws and regulations at state and local levels may be more restrictive than federal regulations. The HA's pest manager should ensure that the applicable regulations are satisfied.

SECTION B CHARACTERISTICS AND RECOGNITION

Rats have caused more human suffering and economic damage than any other vertebrate pest. It is estimated that rats destroy twenty percent of the world's food supply every year, by feeding on or contaminating it. Rats have adapted to nearly all human environments. They live in granaries, fields, city sewers, attics, basements, on roofs and street trees.

Rats can leap three feet straight up and four feet horizontally. They can scramble up the outside of a pipe three inches in diameter, climb inside pipes of one-and-a-half to four inches in diameter, and pass between buildings on telephone or power lines. Rats can swim through a half mile of open water, tread water for up to three days, swim against a strong current in a sewer line, and dive through a sewer trap to pop up inside a toilet. They can fall more than 50 feet and survive.

Rats gnaw constantly, and their teeth are extremely hard. They commonly chew through building materials such as concrete block, aluminum siding, sun-dried adobe brick, wall board, wooden cabinets, lead sheathing, and plastic or lead pipes. After gnawing a hole, an adult rat can compress its body and squeeze through a half-inch opening.

Rats are very wary. Hundreds may be nesting in a city block, in underground burrows, in sewers, on roofs, and inside buildings, and few people in the area will realize it, even though their populations may be excessive.

Successful long-term rat control is not simple. The key is to control the environment of rat populations, not individual rats. Rat control requires an integrated approach that includes nonlethal tools such as careful inspection, upgraded sanitation, and rat-proofing structures to exclude rat entry. Lethal control may combine the use of selected rodenticides with low-risk control measures such as snap traps or glue boards.

SECTION C HAZARDS OF INFESTATION

1. RATS AS DISEASE CARRIERS

Rats are responsible for the spread of many diseases. Sometimes they transmit the disease directly, by contaminating food with their urine or feces. At other times they transmit disease indirectly; for example, fleas may first bite an infected rat, then a person. Following are some typical diseases associated with rats.

a. Plague

The "Great Plague" of London killed half of the city's population. The "Black Death" of Europe lasted 50 years in the 14th Century and killed 25 million people. In the first quarter of this century, an estimated eleven million people died in Asia from plague. The disease is transmitted to human beings primarily by the oriental rat flea. The flea bites an infected rat and then, while feeding on people, inoculates them with the bacteria that cause disease.

Although no major urban outbreak of plague has occurred since 1924, this is not a disease of the past. A reservoir of plague exists in some populations of wild rodents in several Western states, and human beings contacting these rodents could contract the disease. As suburbia expands into undeveloped areas, wild rodents can transmit the disease to urban rats. There is concern that an outbreak of urban plague could occur in the United States.

b. Murine Typhus Fever

Murine typhus, which occurs in California and in the southeastern and Gulf Coast states, is a relatively mild disease. Murine typhus is transmitted from rats to people by rat fleas, with the disease organism entering the bloodstream when feces of infected fleas are scratched into a flea-bite wound.

c. Rat-Bite Fever

Rats bite thousands of people each year, and most bites occur in inner cities. In some cases victims, particularly infants and bed-confined elderly persons, are bitten in the face while sleeping. Those who are bitten may develop rat-bite fever from the bacteria carried on the teeth and gums of rats. Although the disease is similar to flu, it can be fatal, and is of particular risk to infants.

d. Salmonella Food Poisoning

Rats frequent sewers, rotting garbage, cesspools, and similar sites where *Salmonella* bacteria thrive. Such rats can infest stored food, leave bacteria on dishes, silverware, or food-preparation surfaces, and thus transmit *Salmonella* food poisoning to people.

e. Leptospirosis or Weil's disease

This disease is seldom fatal to people. The disease organisms are spread from rat urine to water or food, and affect people through mucous membranes, minute cuts, and abrasions of the skin.

f. Trichinosis

Trichinosis results from a nematode (a tiny roundworm) that invades intestines and muscle tissue. Both people and rats get the disease from eating raw or undercooked pork infected with the nematode. Rats help spread trichinosis when hogs eat food or garbage contaminated with infested rat droppings.

SECTION D KINDS OF RATS

In the United States, the two typical species of rats are the Norway rat (*Rattus norvegicus*, see Fig. 16-1) and the roof rat (*Rattus*, see Fig. 16-2). The Norway rat is also called the brown rat, house rat, sewer rat, and wharf rat. The Norway rat is considered the most common in the U.S. and is found in every state. The roof rat, also called the black rat, ship rat, and Alexandrine rat, is found primarily in coastal areas including California, Washington, and Oregon, the Southeast and Middle Atlantic States, and the Gulf States.



Figure 16-1

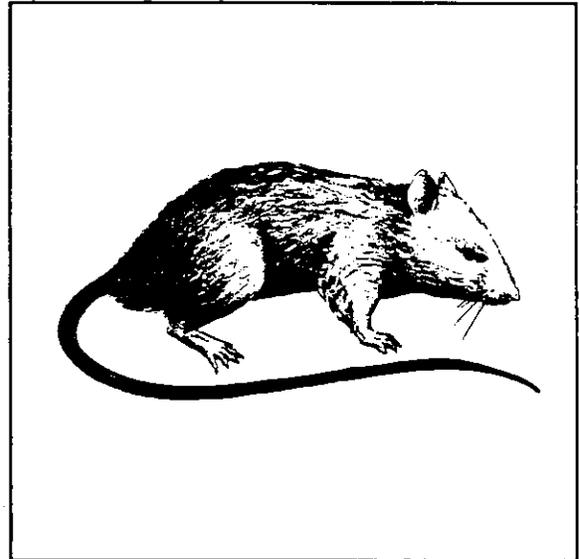


Figure 16-2

The two species look similar, but there are noticeable differences. In general:

- A Norway rat looks sturdier than the roof rat; the roof rat is sleeker.
- A mature Norway rat is 25 percent longer than a roof rat, and weighs twice as much.
- A Norway rat's tail is shorter than the length of its head and body combined; a roof rat's tail is longer than its head and body.
- A Norway rat's ears are small and covered with short hairs; a roof rat's ears are large and nearly hairless.
- A Norway rat's snout is blunt; the roof rat's snout is pointed.

SECTION E HABITS OF RATS

Knowledge of the life history, habitat, food requirements, patterns of behavior, range, and other factors is essential to the control of rat infestations. Since Norway and roof rats have similar habits, most of these discussions apply to either species.

1. LIFE CYCLE

A mature female rat can give birth to about twenty young in a year (four to six at a time), if she lives that long. The average life span of a rat in the field is less than one year, although females live longer than males.

The young are born in a nest. They are hairless, and their eyes and ears are closed. Within two weeks their eyes and ears open, they become furry and rat-like, and they begin exploring the nest area. In the third week they begin to eat solid food, and imitate their mother in foraging, escaping, and watching for danger.

If the mother rat has become wary of rodenticides or traps, many of her young will learn to avoid them. This learning experience can make control difficult in sites where long-term rodent-baiting programs have been unsuccessful in the past.

The young are totally weaned at four or five weeks old, when they weigh about 1-1/2 ounces, and at the age of three months, they are independent of their mother. They will mate and continue the cycle in the same location, or will migrate to a new area.

2. SOCIAL BEHAVIOR

Rats live in colonies with well-defined territories that they mark with urine and glandular secretions. The colony has a complex social hierarchy with a dominant male leader and a "pecking order" of subordinate males and ranking females. The strongest and most dominant animals occupy the best nest and resting sites, and feed at their leisure. Weaker, subordinate rats are pushed out to less favorable sites, or forced out of the territory completely. Rats are aggressive, and social conflicts are most common at feeding sites, prime resting areas, and territorial boundaries. Females fiercely defend their nest and young from other rats.

3. RAT SENSES

a. Vision, Touch, Taste, Balance

Rats have poor vision; they are nearly color blind, and react to shapes and movement rather than identifying objects by sight. Thirty to forty-five feet is the limit of their vision, and their eyes are adapted to dim light. Other senses, however, compensate for poor vision. They use their sensitive noses to locate food, follow pathways, tell whether another rat is friend or foe, and identify new objects in their territory. They use long whiskers and guard hairs to "touch" their way through dark burrows, pipe chases, wall voids, and other runways. Their ears detect faint sounds that signal danger. Rats can taste certain chemicals at a parts-per-million concentration. (This explains why rats often reject baits or avoid traps that have been contaminated with insecticides.) Finally, rats have an excellent sense of balance which allows them to walk on wires and always land on their feet in a fall.

b. Fear of New Objects (Neophobia)

Rats are wary of anything new that appears in their territory. A bait station, a trap, a block of wood will be avoided for a few days until the rats become familiar with the new object; even then, they approach cautiously. This fear of new objects can make baiting and trapping difficult. Rats will avoid poison bait when it is first placed. Later, they may nibble warily. If the poison bait makes them ill, but doesn't kill them, they will subsequently avoid similar baits or stations.

4. FOOD AND WATER

Rats need about one ounce of food daily. Norway and roof rats prefer different types of food. Norway rats prefer protein-based foods such as meat, fish, insects, pet food, nuts, and grain. Household garbage is ideal food for Norway rats. Roof rats prefer plant materials such as fruits, nuts, seeds, berries, vegetables, and tree bark. They occasionally feed on garbage and meats. Both rat species will feed on nonpreferred food if nothing else is available.

Rats may hide or hoard food in hidden areas. This food may or may not be eaten when other food supplies run short. Hoarding food is important for three reasons. First, rats may be moving toxic bait into areas where perhaps the label does not permit its use. Second, rats may be hoarding poison bait while feeding on their regular food. In this case, a baiting program becomes ineffective. Third, hidden food may become a focal point for insect infestations.

Rats need water every day. The amount varies, depending on the moisture content of their food, but is usually around one-half to one fluid ounce. Rats prefer to nest where water is available.

5. RANGE

Rats usually begin foraging after dark. Most of their food gathering occurs between dusk and midnight, but short bursts of restlessness and activity can occur anytime, day or night. Rats commonly travel 100 to 150 feet from their nest looking for food and water and patrolling their territory. It is not unusual for a colony that nests outdoors to forage inside a building 100 feet away.

6. NESTS

Outdoors, Norway rats usually nest in burrows dug into the ground. The burrows are shallow (less than eighteen inches) and usually short (less than three feet), with a central nest. Extra "bolt holes" are used for emergency escapes. They are hidden under grass or boards or lightly plugged with dirt. Burrow openings are two to four inches in diameter. Indoors, Norway rats nest inside walls, in the space between floors and ceilings, underneath equipment, between and under pallets, and in crawlspaces, storage rooms, and any cluttered area that is normally unoccupied. Norways prefer to nest in the lower floors of a building.

Roof rats commonly nest above ground, in trees, particularly untrimmed palm trees, and in piles of wood or debris, vine-covered fences, and stacked lumber. Overgrown landscaping is also a prime nesting area. Roof rats will sometimes nest in burrows if above-ground sites are limited and Norway rats are not nesting in the area. Indoors, roof rats prefer the upper levels of a building, in the attic and ceiling and attic voids, near the roof line. But at times, they will nest in the lower levels of a building.

Both species also nest in sewers and storm drains, and highly unusual nest sites, and can have several "hotel" nest sites in an area. A rat may spend a week in its home base and then move for a day or two into a secondary "hotel" nest site. Norway rats have been shown, on occasion, to have a home range of up to twenty acres when these secondary nest sites were included in calculations.

SECTION F INSPECTION AND MONITORING

There are many signs of a rat-infested area which assist the Inspector in identifying where rats are feeding and nesting, their patterns of movement, the size of population, and the extent of infestation. This helps the HA decide what control measures to use, where and how to use them, and how much effort is needed to control the infestation.

1. SIGNS OF RATS

An inspection using a powerful flashlight after dark is the best way to see live rats. Dead rats are signs of either a current or past infestation. Dried carcasses and skeletons may indicate an old infestation. Fresh carcasses may indicate a recent poison baiting. If rats are seen during the day, the rat population is probably high.

2. SOUNDS

Squeaks and fighting noises in a building, clawing, scrambling, or gnawing sounds in walls may indicate the presence of rats. Use a stethoscope or electronic listening device to help pinpoint such noises.

3. DROPPINGS

A rat may produce 50 droppings daily. Roof-rat droppings are generally smaller (a half-inch) than the Norway rat's (three-quarter inch). The highest number of droppings will be found in locations where rats rest or feed. Determine if a rat population is active by sweeping up old droppings, then reinspect a few days to a week later for new droppings.

Look at the appearance of droppings to determine if rats are present. Fresh rat droppings are black, glisten and look wet, and have the consistency of putty. After a few days the droppings become dry, hard, and appear dull. After a few weeks, droppings become gray, dusty, and crumble easily. Note that sometimes old droppings moistened by rain may look like new droppings; however, if crushed, they will crumble.

4. URINE

Both wet and dry urine stains will glow blue-white under an ultraviolet light (blacklight). Use portable ultraviolet light, as used in the food industry, to identify rat urine on food and other items. Other substances besides rat urine also glow, which can be confusing, so proper use of this inspection method takes practice.

5. GREASE MARKS

Oil and dirt rub off of a rat's coat as it runs along walls. Grease-mark build-up in frequented runways is noticeable. Look for grease marks along wall and floor junctions, at pipes, ceiling joists, and sill

plates, where rats swing around obstacles. Grease marks are also found at regularly used openings in walls, floors, and ceilings.

6. RUNWAYS

Outdoors, rats constantly travel the same route; their runways appear as beaten paths on the ground. Look for such paths next to walls, along fences, and under bushes and buildings. Indoor runways of rats may appear as well-polished trails which are free of dust.

7. TRACKS

A rat's footprint is about 3/4-inch long, and may show four or five toes. Rats may also leave a "tail drag" line in the middle of their tracks. Look in dust or soft moist soil. Place a tracking patch in suspected rat areas to show footprints. A tracking patch is a light dusting of an inert material such as clay, talc (unscented baby powder), or powdered limestone. Don't use flour, which may attract insect pests. A good patch size is 12x4 inches. Apply patches in suspected runways and near grease marks. When inspecting tracking patches, shine a flashlight at an angle that causes the tracks to cast a distinct shadow. Note that a tracking patch is not the same as tracking powder. Tracking powders are diluted rodenticides in dust form. Tracking patches use nontoxic dust. Do not use a tracking powder to make a tracking patch.

8. GNAWING DAMAGE

A rat's incisor teeth grow at a rate of about five inches per year. Rats keep their teeth worn down by continuously working them against each other and by gnawing on hard surfaces. Look for gnawing damage on floor joists, ceiling joists, door corners, kitchen cabinets, and around pipes in floors and walls as evidence of rat infestation. Gnawed holes may be two inches or more in diameter.

9. NEST SITES

Roof rats often nest or store food in the attics of buildings. Their nests may also be found in trimmed dense vegetation.

10. BURROWS

Outdoors, rat burrows may be found singly or in groups along foundation walls, under slabs and dumpster pads, in overgrown weedy areas, beneath debris, and in embankments. Look for a burrow

opening that is free of dirt, leaves, and debris; however, the openings may be covered with smooth, hard-packed soil. Look for rub marks at the opening, and soil pushed out in a fan-shaped pattern.

Fill the opening with a small amount of wadded-up newspaper or a few leaves and cover it with loose soil. Or, just kick in the open entrance to close it. If the rats are still using the burrow, they will reopen and clear the hole overnight.

11. PET EXCITEMENT

Cats and dogs may excitedly probe an area of floor or wall where rats are present, especially if the rats have recently invaded.

12. ODOR

Heavy infestations have a distinctive odor which can be identified with practice. The odor of rats can be distinguished from the odor of mice.

13. ESTIMATING RAT NUMBERS

It's not easy to tell how many rats are infesting a site. Rat signs, however, may categorize the population as low, medium, or high. In rat-free or low infestation conditions, no signs are seen. In the case of medium infestation, old droppings and gnawing can be observed and one or more rats are seen at night. No rats are seen during the day. When there is a high infestation, fresh droppings, tracks, and gnawings are common. Three or more rats are seen at night, and rats may be seen in the daytime as well.

SECTION G CONTROLS

Most successful rat-control programs use a combination of tools and procedures to reduce and control a rat population. The methods combine habitat alteration and population reduction. Some of the tools, such as trapping, are lethal to the rat. Some tools are not. Rat-proofing by making building repairs or increasing the frequency of garbage pickup are examples of nonlethal methods.

1. SANITATION

Rats may ignore bait since it can't compete with the rats' regular food. Reducing rats' normal food supply encourages them to move to some other territory. This can be accomplished by closing or

repairing open or damaged dumpsters and garbage containers, cleaning up food spills promptly, and not allowing food to be left out overnight.

2. ELIMINATE HIDING PLACES

Outdoors, remove plant ground covers such as ivy near buildings. Remove high grass, weeds, wood piles, and construction debris that permits rats to live and hide adjacent to a building. Indoors, eliminate clutter in dwelling units and rarely used rooms, basements, storage rooms, equipment rooms. Organize storage areas.

3. RAT-PROOFING (EXCLUSION)

The most successful long-term form of rat control is to build them out, called rat-proofing, a technique that makes it impossible for rats to get into a building in the first place.

a. Building Exterior

Seal cracks and holes in building foundations and exterior walls. Block openings around water and sewer pipes, electric lines, air vents, and telephone wires. Install 1/4-inch steel wire screen or hardware cloth on ventilation openings. Caulk and seal doors to ensure a tight fit, especially between door and floor threshold. Fit windows and screens tightly. Caulk and close openings on upper floors and the roof; inspect under siding and repair damaged soffits. Repair breaks in the foundation below ground level.

b. Building Interior

Seal spaces inside hollow block voids or behind wallboard. Repair broken blocks and holes around pipes. Repair gnaw holes or stuff them with copper wool. Equip floor drains with sturdy metal grates secured firmly in place.

4. TRAPPING

Trapping is an art that has been almost forgotten. The usefulness and great versatility of snap or guillotine traps where toxicants cannot or should not be used is rarely recognized. The snap trap is an effective method of killing rats when used correctly, and is advised for use inside structures. It has several advantages: there is less nontarget risk than from a toxicant bait, the pest manager knows instantly whether or not the trap has been successful, and it allows disposal of the carcass so that

there are no odor problems. Carcass disposal also eliminates the possibility of secondary infestation by blowflies and dermestid beetles that would feed on it. Traps should be strategically placed in sufficient number, otherwise rats will pass them by.

a. Physical Condition of Traps

A trap physically incapable of holding a rodent should never be set out. Staples holding the spring should be firm; the trap jaw should be square and fit inside the trap base. The trigger mechanism should operate smoothly at the slightest touch. Use properly sized traps for the species to be controlled: mousetraps for mice; rat traps for roof and Norway rats. The trap base should not be warped or the trap will rock when stepped on. If necessary, working parts should be lightly oiled with mineral or other inorganic oil, not machine oil. Traps should be kept away from pesticides or other strong odors that might be repellent to the rodents. Don't clean a trap bloodied by a catch, since the odors enhance its acceptance. A shiny new trap increases the possibility of rejection in response to the "new object avoidance" instinct. For some situations, the best traps are those with enlarged bait pans (triggers) set for a light touch.

b. Enlarged Bait Pans

Traps should have enlarged bait pans. Commercial traps with expanded bait pans are available, but the old style traps can easily be adapted with wire screen or light metal cut from beer cans. The enlarged bait pan should be trimmed so that it is 1/4-inch smaller than the trap jaw wire and securely fastened to the standard bait pan.

c. Placement of Traps

Traps with enlarged bait pans, if properly placed in runways, do not need to be baited, but baiting adds to their effectiveness. Smear peanut butter in the center of the bait pan; sprinkle oats lightly across the pan; or tie a nutmeat or dried fruit piece to the center of the pan. Meat such as sausage or bacon, or peanut butter, is attractive to Norway rats, while fresh or dried fruit will draw roof rats. Cotton balls also are attractive to females of both rat species. Traps must be placed in the rodents' regular active runways, as indicated by the presence of feces, smears, or tracks.

Place light tracking patches of talc, powdered limestone, or other odorless, innocuous fine-particled material to find where the rodents are most active, and place traps there. All traps should be set perpendicular to and across the runway so that the bait pan is in the runway, and against the wall or other vertical surface. Make narrow runways to force the animals to cross over

the trap pan. Put traps in concealed places where rodents are more apt to be found rather than in places the trapper can easily reach. Trap the area heavily, every ten to twelve feet. Map the locations so traps can be more easily recovered later or by someone else if necessary. Move traps to other areas after two weeks (the first area can be retrapped after a lapse of several weeks).

Adhere to good public relations practices, and pick up trapped animals as soon as possible (at least daily). In areas used frequently by the public, use trap stations to cover trapped animals instead of snap traps. This also protects the traps from accidental tripping by maintenance personnel. Don't place traps above food or food-handling areas or in areas where pets or children can reach, since rat traps can break their small bones.

Leaving the traps unset for a few days may increase the catch by reducing the chance that wary rats will trip the traps without capture. Set traps with bait, if food for rats is in short supply, and without bait if they have enough.

When runways are located on rafters and pipes, set expanded trigger traps directly across them, fastening them securely to pipes with wire or hose clamps, and to rafters with nails (Fig. 16-3). Use enough traps. Set five or ten traps in an active corner of a space. Set three traps in a row so that a rat, leaping over the first, will be caught in the second or third. If unsure about sites of activity, set traps along possible runways spaced ten to twelve feet apart.

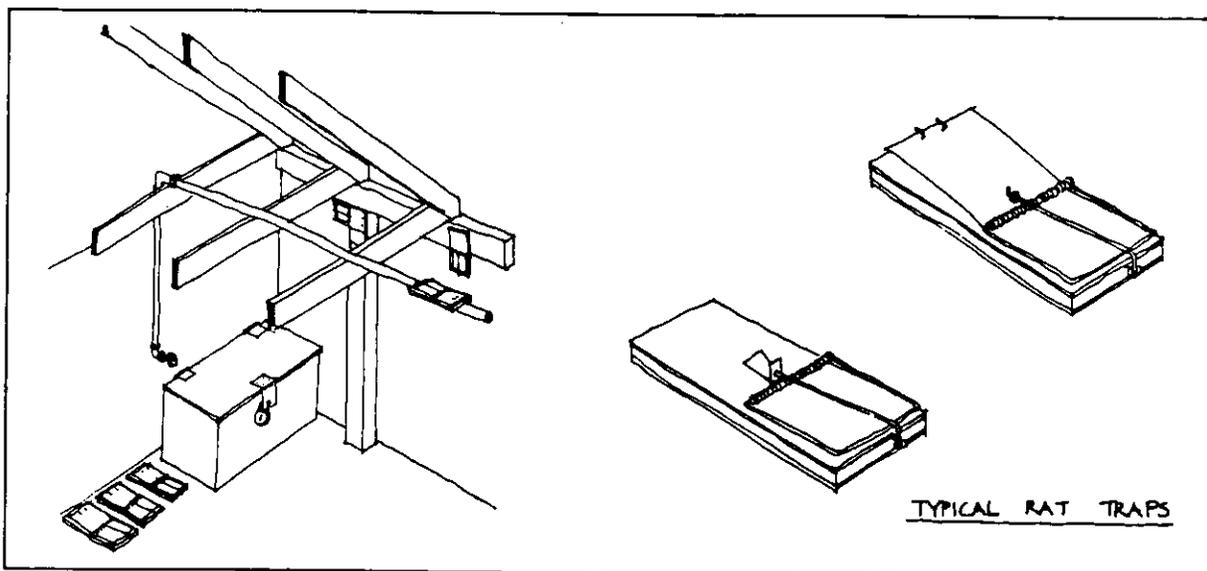


Figure 16-3

Camouflage traps when only a few rats remain and are difficult to capture. Set traps in a shallow pan of meal, sawdust, or grain. In stubborn cases, expose food in shallow pans until the rats

readily feed on it. Then add a buried trap. Inspect traps frequently to remove dead rodents and change old bait.

d. Glue Boards

Rats can also be trapped with sticky glue boards. Although most often used against mice, glue boards are also effective against rats. In the latter case, larger glue boards should be used, designed to trap an animal the size of a rat. There are, however, some drawbacks to glue boards. They are messy and expensive, and cannot be reused. This device catches all four feet of rodents on its sticky surface, and the trapped animal dies quickly, when its nostrils get plugged with glue.

The glue boards should be placed in the same location as snap traps; lengthwise and flush along the wall, box, or other object that edges a runway. Overhead runways along pipes, beams, rafters, and ledges are also good sites for placing glue boards. Adding a dab of bait to the center of the glue board may improve its effectiveness.

Don't place glue boards directly over food or food-preparation areas. Secure the glue board with a nail or wire so a rat can't drag it away. Install glue boards in covered stations if people might be upset to observe a struggling rat, where children or pets could come in contact with the glue, or in areas with excessive dust or moisture. Check glue boards frequently and dispose of rodents.

5. RODENTICIDES

A rodenticide is a pesticide designed to kill rodents. There are three major formulations of rodenticides used to control rats: food baits, water baits, and tracking powders. Toxic baits may be used outdoors under some controlled circumstances. The disadvantage of toxic baits or tracking powders is that it is difficult or impossible to recover the carcass, and there is a risk of secondary poisoning of nontarget animals such as cats and dogs, or of having to control secondary insect infestations such as blowflies or dermestid beetles that feed on the carcass.

a. Food Baits

Rat baits combine a poison effective against rats with a food bait attractive to them. Baits can be purchased ready-made and packaged as extruded pellets, in a dry meal, or molded into paraffin blocks for wet sites. Baits may be obtained in all sizes—from 45-pound bulk tubs to place-packs containing less than one ounce of bait.

Some baits kill rats after a single feeding, some require multiple feedings. Some are anticoagulants (which cause rats to bleed to death), some affect respiration, and others have totally different modes of action. Some baits are only slightly toxic to people or pets, others are moderately or very toxic. Unfortunately, old poisons that killed rodents by affecting the stomach were also toxic to human beings.

Another rodenticide, called warfarin, was developed in the 1940s; it interferes with the blood's clotting mechanism. Others are coumafuryl, chlorophacinone, diphacinone, pindone and valone. While these anticoagulants are effective and do not cause bait shyness, they could be lethal to people as well as pets. Consumption of rodenticides in quantities over several days results in fatalities. Vitamin K is an antidote to these anticoagulants.

The resistance of rodents to anticoagulants and a desire for quicker results led to the development of single-dose anticoagulants including brodifacoum and bromadiolone. In recent years, rodenticides with different modes of action, such as bromethalin or cholecalciferol, have also been proven effective. Zinc phosphide, used as a single-dose nonanticoagulant, is somewhat poisonous to all vertebrates. It is often used as a tracking powder meant to be licked from the fur when rodents groom themselves, and is also incorporated into dry baits. Zinc phosphide should never be applied without wearing gloves.

Rodenticides must be used very carefully because they are dangerous to people and pets. Several general guidelines should be followed when using a poison bait:

- All rodenticides should be kept in their original containers bearing labels warning that the bait is poison and that it should not be placed in locations accessible to children, pets, wildlife, and domestic animals.
- Rodenticides should be kept in tamper-proof containers. Decisions about what are safe, inaccessible areas for placement of rodenticides is determined on a case by case basis. Ask questions like these:
 - Is it possible for a child to reach a place-pack hidden underneath construction materials?
 - Could a guard dog find and eat the bait blocks?
 - Could a squirrel or cat enter the bait box and feed?

If so, change the placement or put the bait inside a tamper-proof bait box. **Toxic baits should not be used inside inhabited structures.**

b. Bait boxes

A tamper-proof bait box is designed so that a child or pet cannot get to the bait inside, but the rat can. (Bait trays and flimsy plastic or cardboard stations are not tamper-proof bait boxes.) Tamper-proof boxes differ in the type and quality of construction. They are usually metal or heavy plastic. Rat-bait stations are larger than those used for mice. Most designs are not considered to be truly tamper-proof unless they can be secured to the floor, wall, or ground.

Ensure that bait boxes are clearly labeled with a precautionary statement. Check stations or boxes periodically to ensure that rats are taking the bait and that the bait is fresh. Rats will rarely feed on bait that has spoiled. Bait boxes should be placed wherever the rats are most active, as determined by droppings and other signs (near burrows, along outside walls, and at other travel sites). When rat populations have been eliminated, remove bait boxes, but continue to monitor for new signs of rodent activity.

Put place-packs in burrows and similar protected sites. If a site is damp, use paraffin bait blocks or other water-resistant formulations. Roof rats often need to be baited in areas above ground such as trees, and roofs. Put out enough bait and check it often. Incomplete baiting can lead to bait shyness and make control difficult.

Be sure to limit or eliminate the rats' normal food supply, otherwise the baits may be avoided. Remember that rats fear new objects at first so that baits may not be eaten for a few days or a week. Once bait is taken, leave the box in place for some time. Rats now consider it to be part of their normal surroundings. Good bait placements can be effective even when placed fifteen to 50 feet apart. Bait placed outdoors can kill rats moving in from nearby areas.

c. Water baits

Rats drink water daily if they can. When water supplies are short, water baits, formulated rodenticides mixed with water, can be effective. Several types of liquid dispensers are available. The best are custom-designed for toxic water baits, but plastic chick-fountains can also be used in protected sites. Use water baits only where no other animals or children can get to them.

d. Tracking Powders

Rats groom themselves by licking their fur. Toxic tracking powder can be used to take advantage of this behavior. This formulation is a rodenticide carried on a talc or powdery clay which is

applied to areas where rats live and travel. The powder sticks to the rats' feet and fur, and is swallowed when rats groom themselves. The major advantage to tracking powders is that it can kill rats even when food and water is plentiful, or if rats have become bait- or trap-shy.

Apply tracking powders more heavily than an insecticide dust (but never deeper than 1/8-inch.) Best application sites are inside dry burrows (when permitted by label). Apply with a hand bulb or bellows duster.

Do not use tracking powders inside buildings occupied by people, or around air ventilators. The powder can become airborne and drift into nontarget areas. The rodenticide in tracking powders is generally five to 40 times more concentrated than that in baits. Tracking powders are formulated with acute poisons or slower-acting poisons.

END OF CHAPTER SIXTEEN